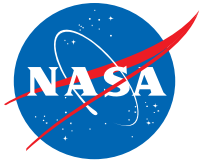
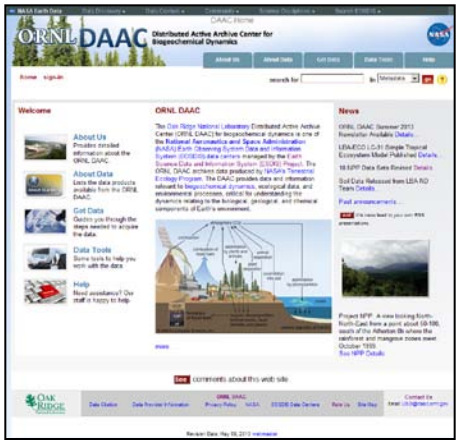


MODIS GLOBAL Subsetting and Visualization Tool Webinar:

Bringing time-series satellite-based land data to the field scientist

Suresh K.S. Vannan and Tammy Walker Beaty
Oak Ridge National Laboratory Distributed Active Archive Center, ORNL DAAC
July 24 and 25, 2013

About ORNL DAAC



- The Oak Ridge National Laboratory Distributed Active Archive Center (ORNL DAAC) for biogeochemical dynamics is one of the National Aeronautics and Space Administration (NASA) Earth Observing System Data and Information System (EOSDIS) data centers managed by the Earth Science Data and Information System (ESDIS) Project, which is responsible for providing users with access to data from NASA's Earth Science Missions.
- The mission of the ORNL DAAC is to assemble, distribute, and provide data services for a comprehensive archive of terrestrial biogeochemistry and ecological dynamics observations and models to facilitate research, education, and decision-making in support of NASA's Earth Science.
- The ORNL DAAC archives data produced by NASA's Terrestrial Ecology Program in support of NASA's Carbon Cycle and Ecosystems Focus Area.
- http://daac.ornl.gov

About ORNL DAAC Data Products and Services

- The biogeochemical and ecological data products and services provided by the ORNL DAAC are organized by project and categorized into four primary groups:

  Field Campaigns – ground-, aircraft-, and satellite-based measurements of biogeochemical features in specific ecosystems over multi-year time periods (e.g., BOREAS, FIFE, LBA, NACP, S2K)

  Land Validation – comprehensive collection of assessments of ground-based observations coincident with satellite data useful for developing, calibrating, and validating ecosystem models (e.g., FLUXNET)

  Regional and Global Data – collections for understanding the structure and function of various ecosystems across multiple spatial and temporal scales (e.g., Climate, Hydroclimatology, Soils, Vegetation, etc.)

  Model Archive – code for benchmark model versions and associated published research results of specific model implementations (e.g., Biome-BGC, CENTURY, EDM, LEDAPS, MAPSS, PnET)

- 4 Categories (30 Projects) = ~1100 Data Products and Services

More about ORNL DAAC Services (Tools)

- The ORNL DAAC provides various tools and services to help researchers readily find and access data sets of interest with features such as: Search, Visualization, Subsetting, and Analysis

  http://daac.ornl.gov/tools.shtml

- The focus of this Webinar is the **MODIS Global Subsetting and Visualization Tool**

  Allows users to order MODIS Land Product subsets for any site, area, and time period globally.

  Point and Gridded Data; Visualization; Subsetting; and Services

  Helps users deal with large data volume, accessibility issues, data format, and processing time

- http://daac.ornl.gov/modisglobal

About the MODIS Global Subsetting and Visualization Tool

- MODerate Resolution Imaging Spectroradiometer

  hyper-spectral sensor onboard two satellites (Terra and Aqua)

  Views the entire Earth's surface every 1 to 2 days, acquiring data in 36 spectral bands (groups of wavelengths)

- MODIS Global Subsetting and Visualization Tool (GUI)

  Site Selection from a pick list or entering a site's geographic coordinates

  Area defining the site can be: from 1 pixel up to 201 X 201 km

  Data for any available time period

- MODIS Web Service

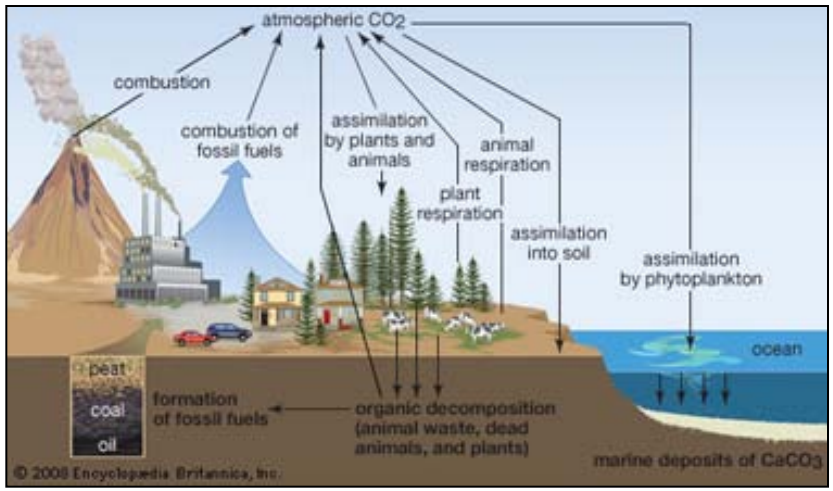
  Programmatically obtain MODIS subsets from any land location, time period and area using Simple Object Access Protocol (SOAP) Web Service

MODIS Global Subsetting and Visualization Tool (Interactive and Web Service) Output

- Time series plots of the selected product measurement

  Available selected products: http://daac.ornl.gov/MODIS/MODIS-menu/products.html

- ASCII file of the pixel values for the selected product along with quality information
- Average & standard deviations for the area selected
- A file that can be imported directly into GIS software
- A land cover grid (IGBP classification) of the area
- An estimate of heterogeneity (Shannon richness and evenness)
- MODIS Phenology time series
- Documentation (including QC Filter Conditions)



MODIS Global Subsetting and Visualization Tool = 6 Simple Steps

- Step 1: Select Location (enter coordinates, move the balloon around, or from a pick list), continue
- Step 2: Select Data Layer and Subset Size, continue
- Step 3: Select Temporal range, provide email address, continue
- Step 4: Order Description and Subset Creation, (Create Subset)
- Step 5: Order Summary and Verification
- Step 6: Order Notification and Data Retrieval – email with Unique URL for each order
- What you get: Visualization has interactive scroll bars, and optional display features; facilitates data download; and provides interface for ordering different land product for same location.

MODIS Global Subsetting and Visualization Web Service

- Simple Object Access Protocol (SOAP) Web Service

  Examples: “getproducts()” – returns a list of available products; getbands(“MOD13Q1”) – returns list of available bands

- Allows users to:

  Retrieve subsets through command line operations

  Get subsets directly into software such as Kepler and Matlab; and integrate the subsets into client side workflows

  Write custom code to use the subsets for visualization or data reformatting

- Several Client and Application examples: http://daac.ornl.gov/MODIS/MODIS-menu/modis_webservice.html

  (e.g. JAVA, Perl and Python Clients; Kepler, R, and Matlab sample code)

ORNL DAAC Points of Contact

- ORNL DAAC User Services Office (uso@daac.ornl.gov)
- Suresh K.S. Vannan, ORNL DAAC Manager (santhanavans@ornl.gov)
- Tammy Walker Beaty, ORNL DAAC Deputy Manager (beatytw@ornl.gov)
- Bob Cook, ORNL DAAC Chief Scientist (cookrb@ornl.gov)

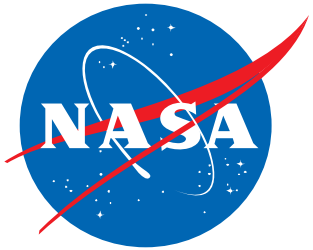
DEMOs

- **MODIS Global Subsetting and Visualization Tool**

  http://daac.ornl.gov/modisglobal

- **MODIS Web Service**

  http://daac.ornl.gov/modiswebservice



Additional Slides follow:

List of Available Products

Steps 1 through 6 of Placing an ORDER with Screen Captures

Output screen captures with explanations

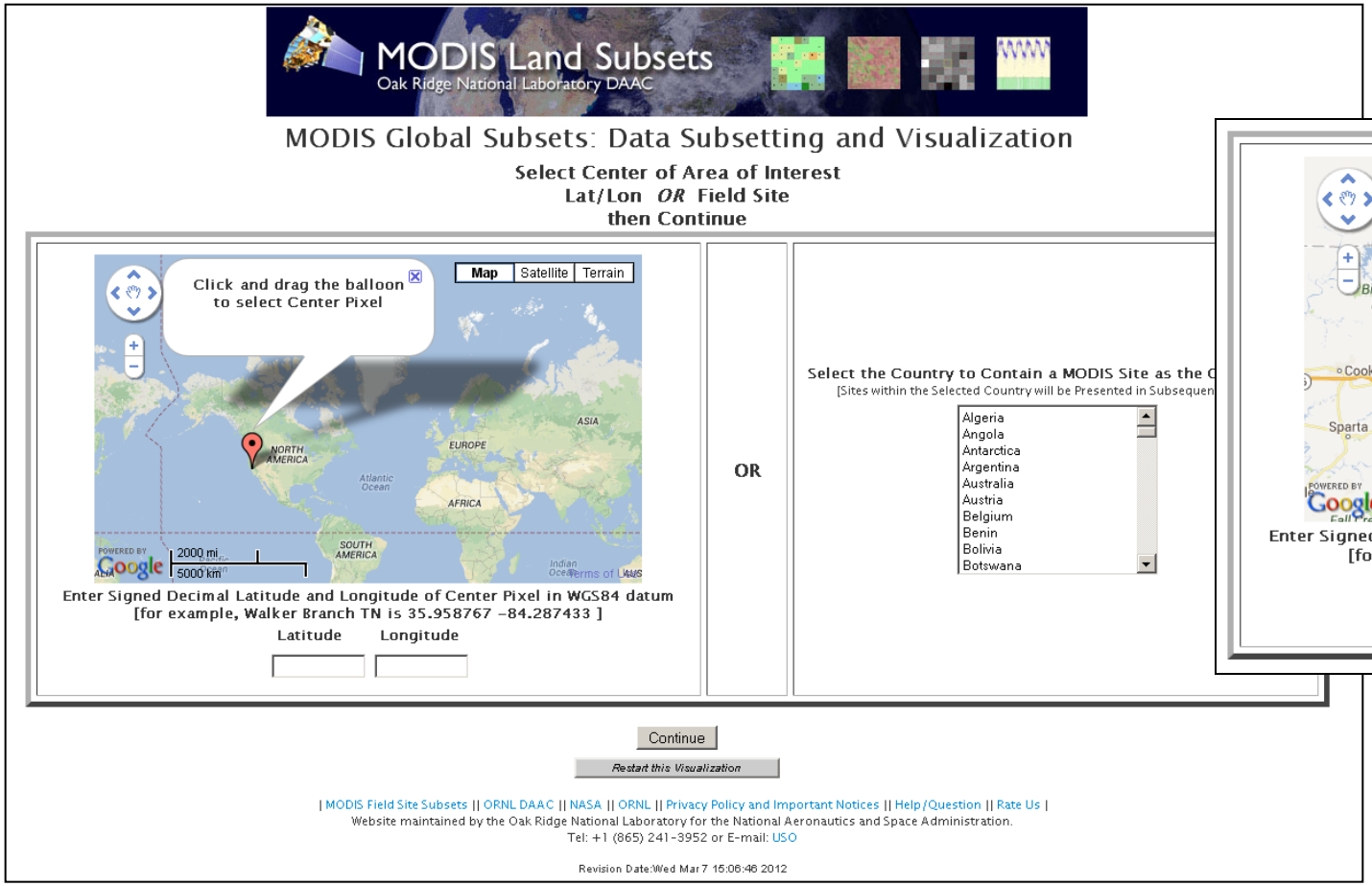
Available MODIS Products

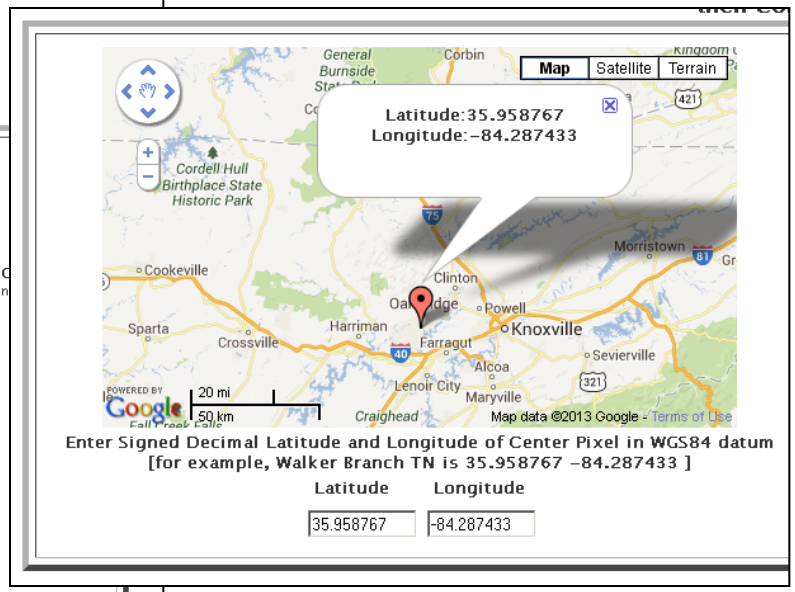
(http://daac.ornl.gov/MODIS/MODIS-menu/products.html)

- Surface Reflectance
- Surface Temperature
- Land Cover
- Vegetation Phenology (life cycle)
- NDVI/EVI (Normalized Difference Vegetation Index and Enhanced Vegetation Index)
- LAI / fPar (Leaf Area Index and Fraction of photo-synthetically active radiation absorbed by vegetation)
- Net Photosynthesis
- Annual NPP (Net Primary Production)
- Calculated Albedo (ratio of diffusely reflected to incident electromagnetic radiation)
- Reflectance – BRDF (bidirectional reflectance distribution function) adjusted

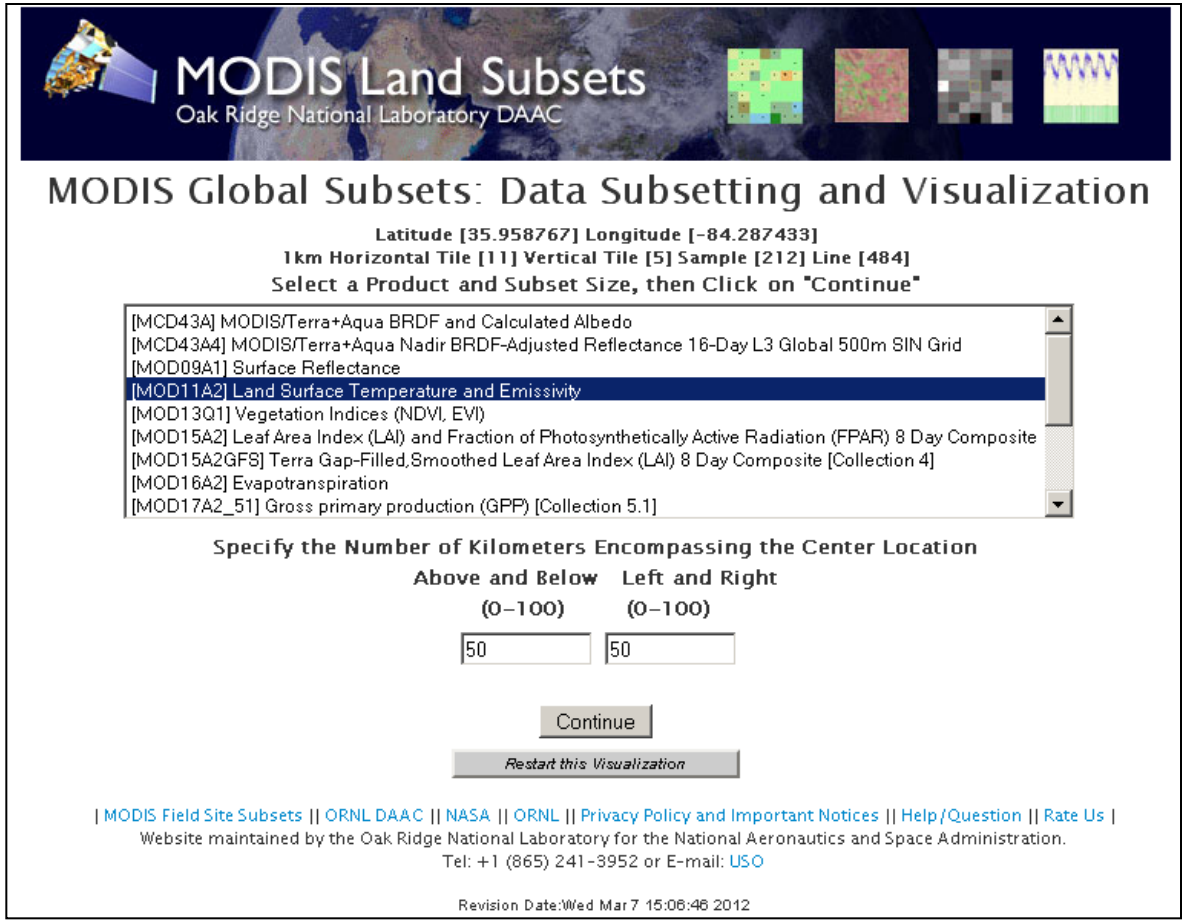
MODIS Global Tool, Step 1 - Select Location

- http://daac.ornl.gov/cgi-bin/MODIS/GLBVIZ_1_Glb/modis_subset_order_global_col5.pl

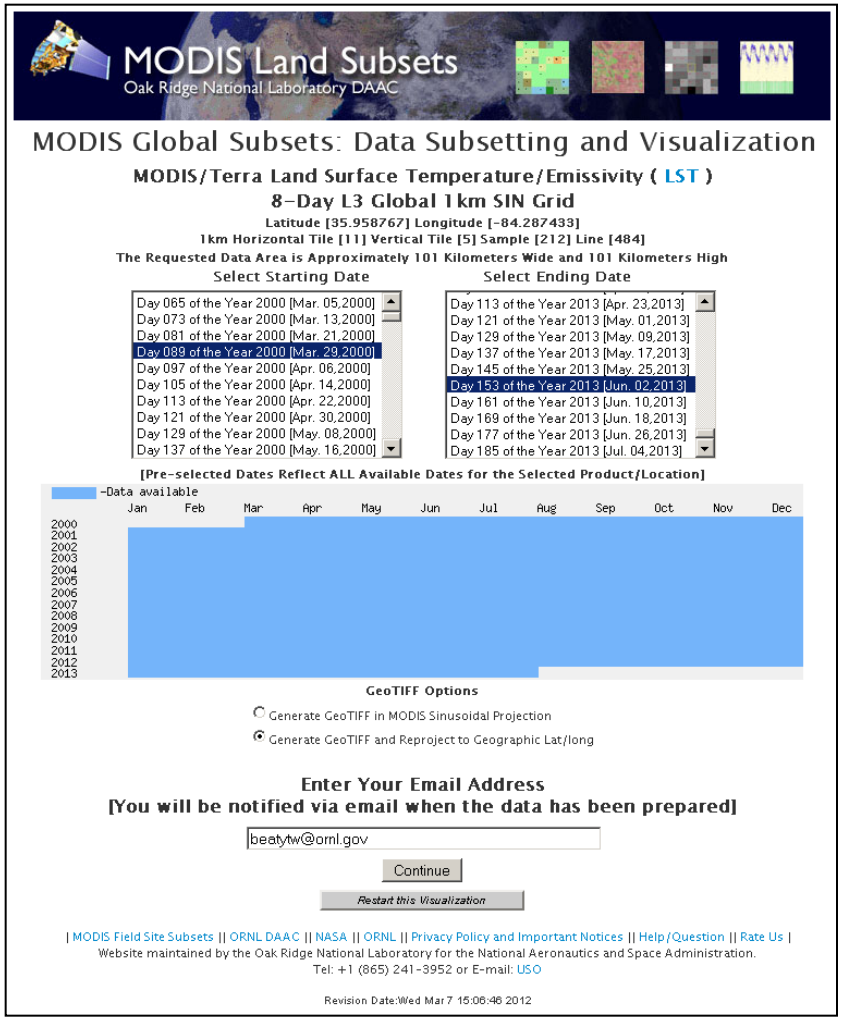




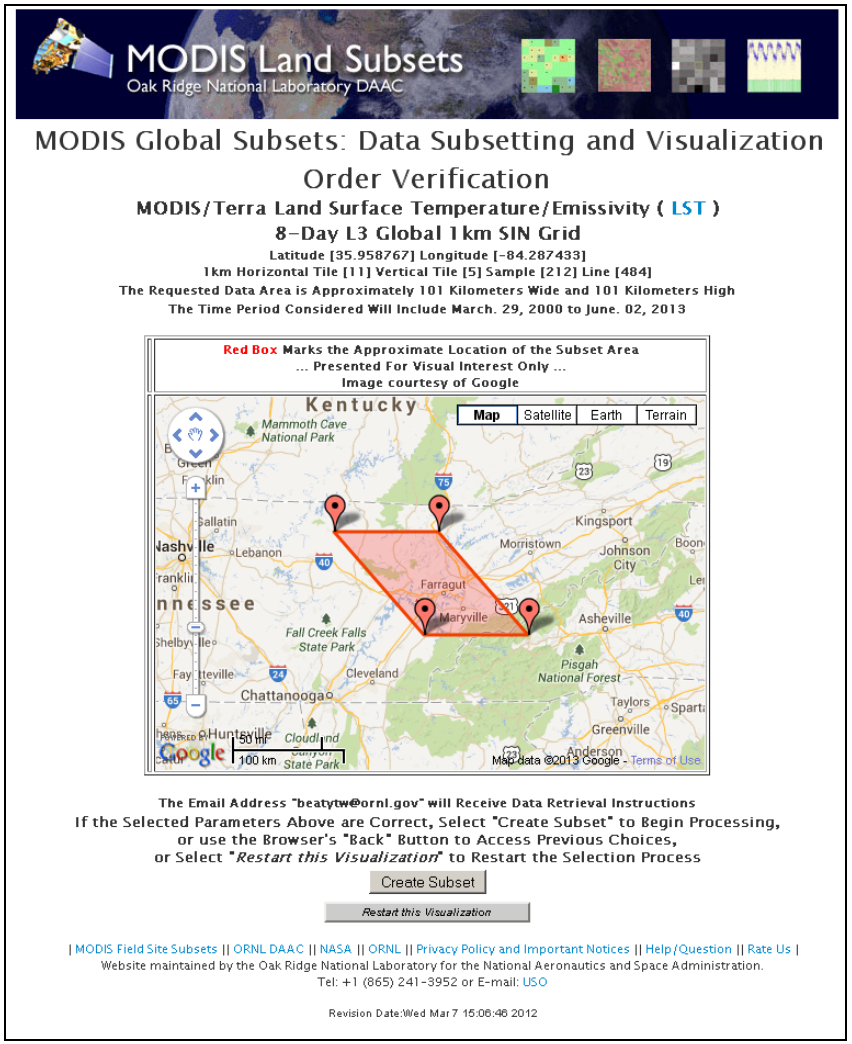
MODIS Global Tool, Step 2 - select data layer and subset size (LST and 50 X 50)



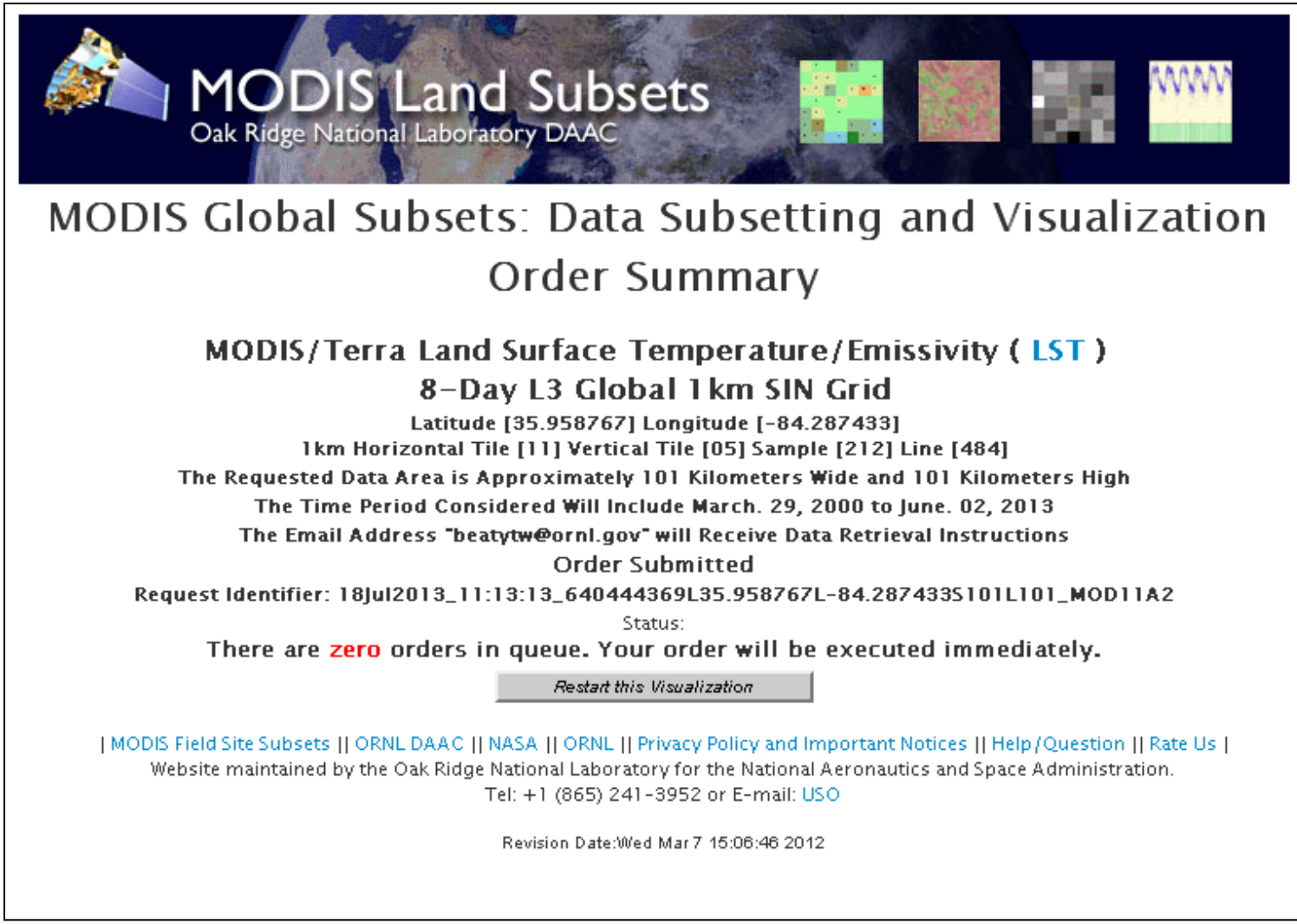
MODIS Global Tool, Step 3 - select temporal range, GeoTIFF Options, provide email address, and submit



MODIS Global Tool, Step 4 – Order Verification and Subset Creation



MODIS Global Tool, Step 5 – Order Summary



MODIS Global Tool, Step 6 – order notification and data retrieval

- Link to visualization and data
- Citation

ORNL DAAC MODIS MOD11A2 order - Message (Plain Text)

File Edit View Insert Format Tools Actions Help

Reply | Reply to All | Forward

Extra line breaks in this message were removed.

From: uso@daac.ornl.gov Sent: Thu 7/18/2013 11:32 AM

To: Beaty, Tammy

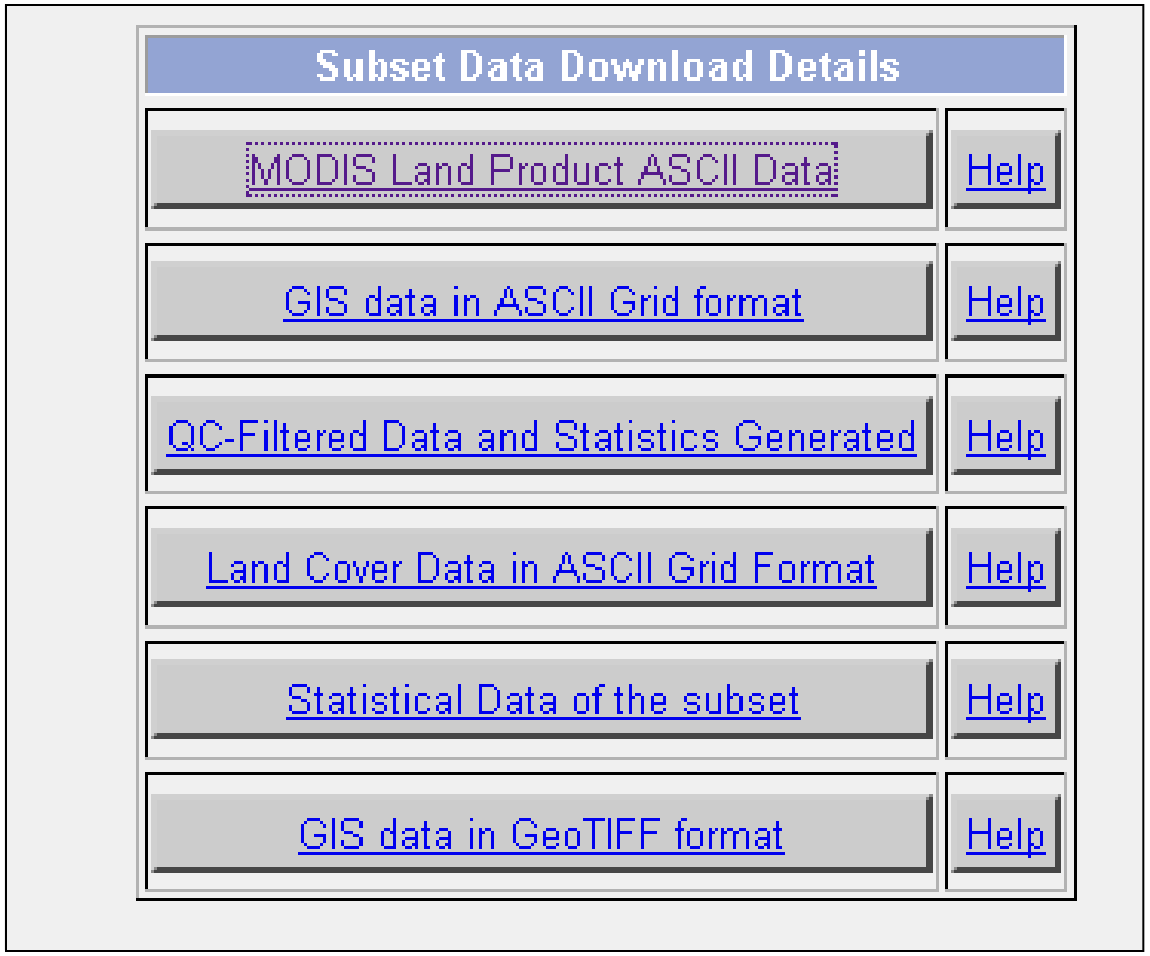
Cc:

Subject: ORNL DAAC MODIS MOD11A2 order

```
ORNL DAAC MODIS Subset Order

Click on the following URL to obtain your results.
http://daac.ornl.gov/glb_viz_2/18Jul2013_11:13:13_
640444369L35.958767L-84.287433S101L101_MOD11A2/index.html

Order Summary
Product:MOD11A2
Location Centered on: Latitude [35.958767] Longitude [-84.287433]
Size: Approximately 101 Km wide and 101 Km high Time Period: March. 29,  2000 to June.
02,  2013

This subset order will be deleted 30 days from the date of the order.

Data Citation:
Oak Ridge National Laboratory Distributed Active Archive Center (ORNL DAAC). 2012.
MODIS subsetted land products, Collection 5. Available on-line
[http://daac.ornl.gov/MODIS/modis.html] from ORNL DAAC, Oak Ridge, Tennessee, U.S.A.
Accessed Month dd, yyyy.

Tool Tip:
Get Subsets command line using MODIS Web Service http://daac.ornl.gov/modiswebservice

Contact:
uso@daac.ornl.gov
```

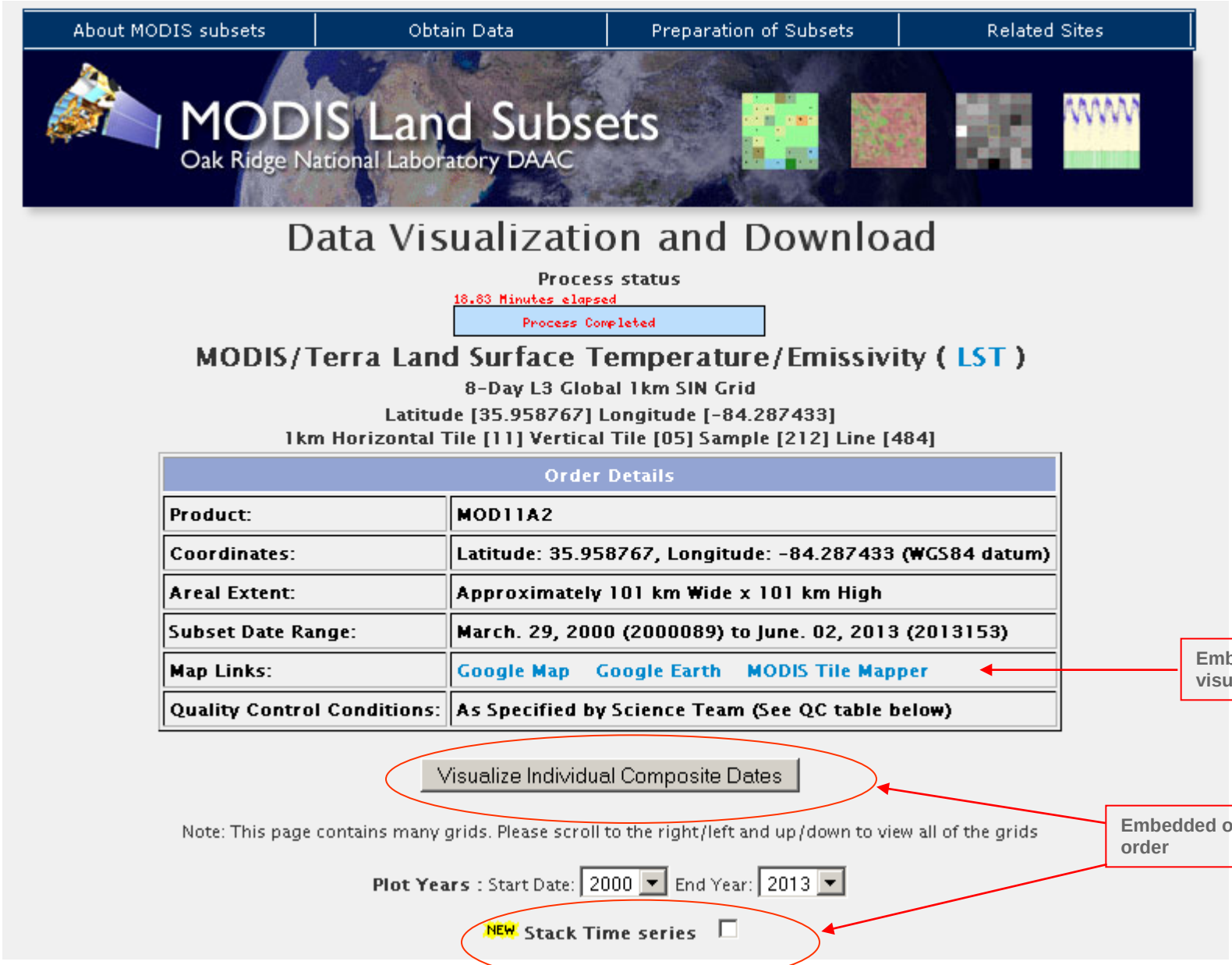
MODIS Global Tool, Data Files can be downloaded

- Each order page has links to the data files (on http server)
- Help files explain contents and format



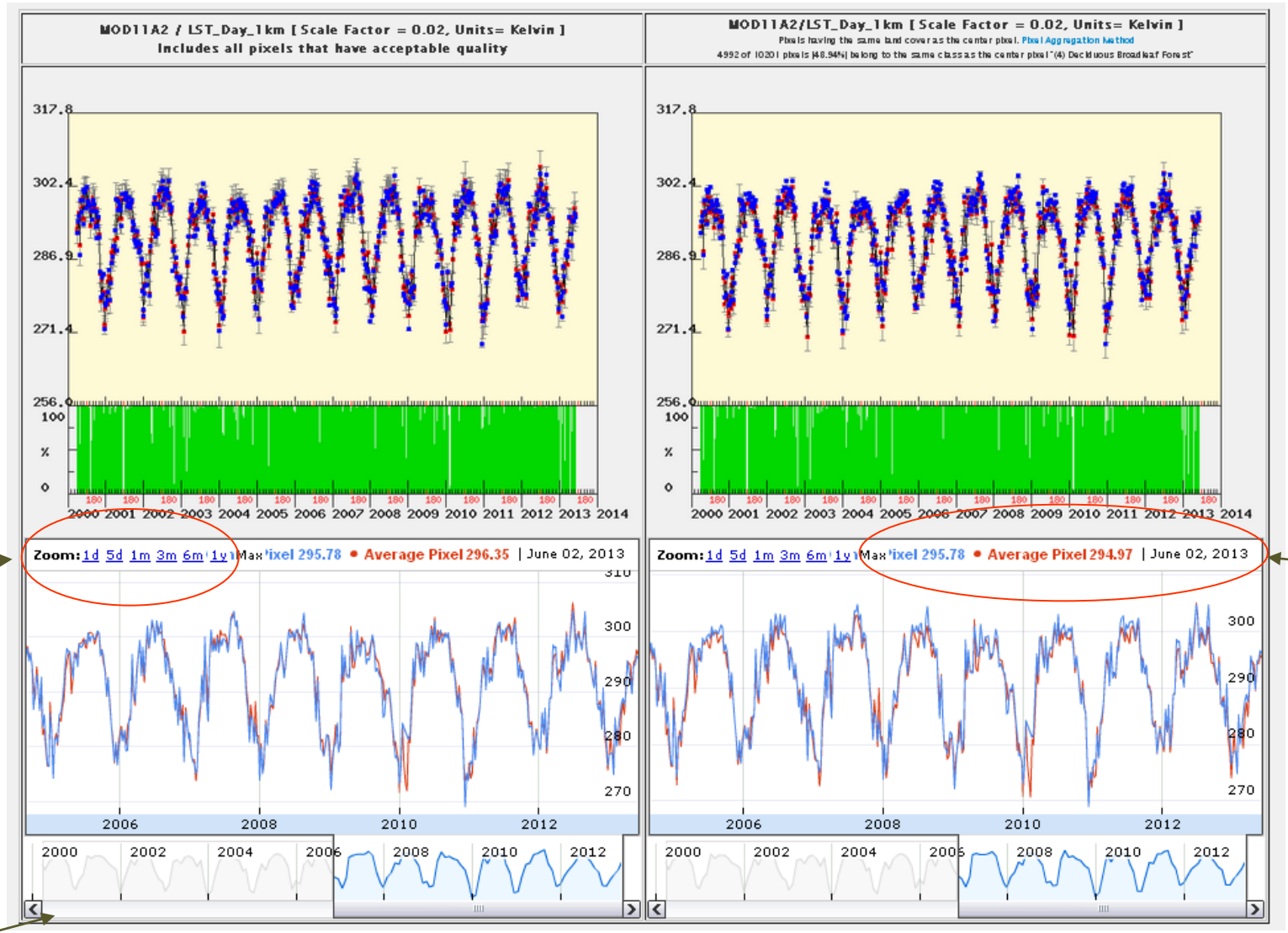
Understanding the Output

- Screen shots follow with annotations



Embedded Links contain visualization options

Embedded options within subset order



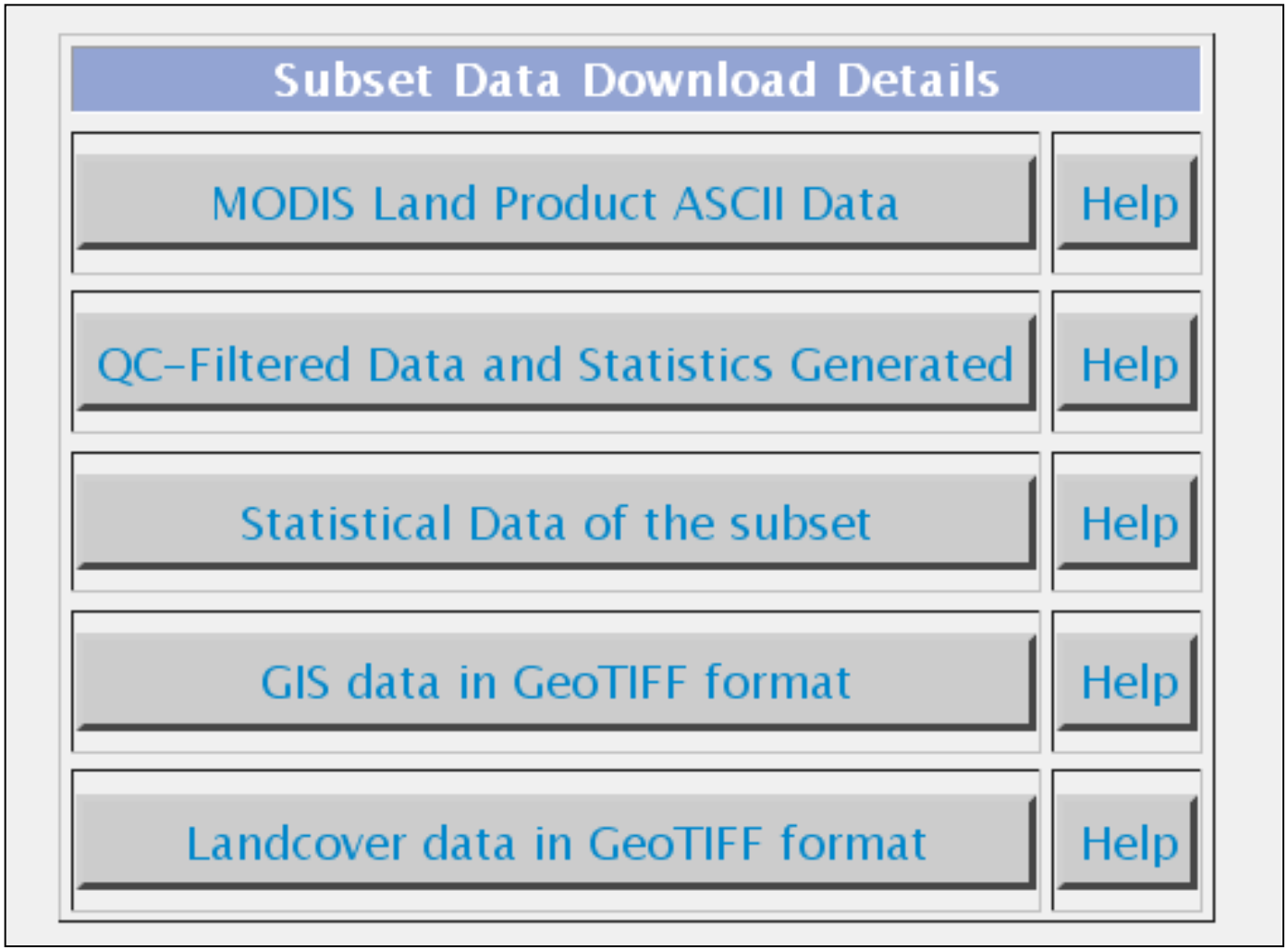
Zoom Options

Cursor display within Visualization

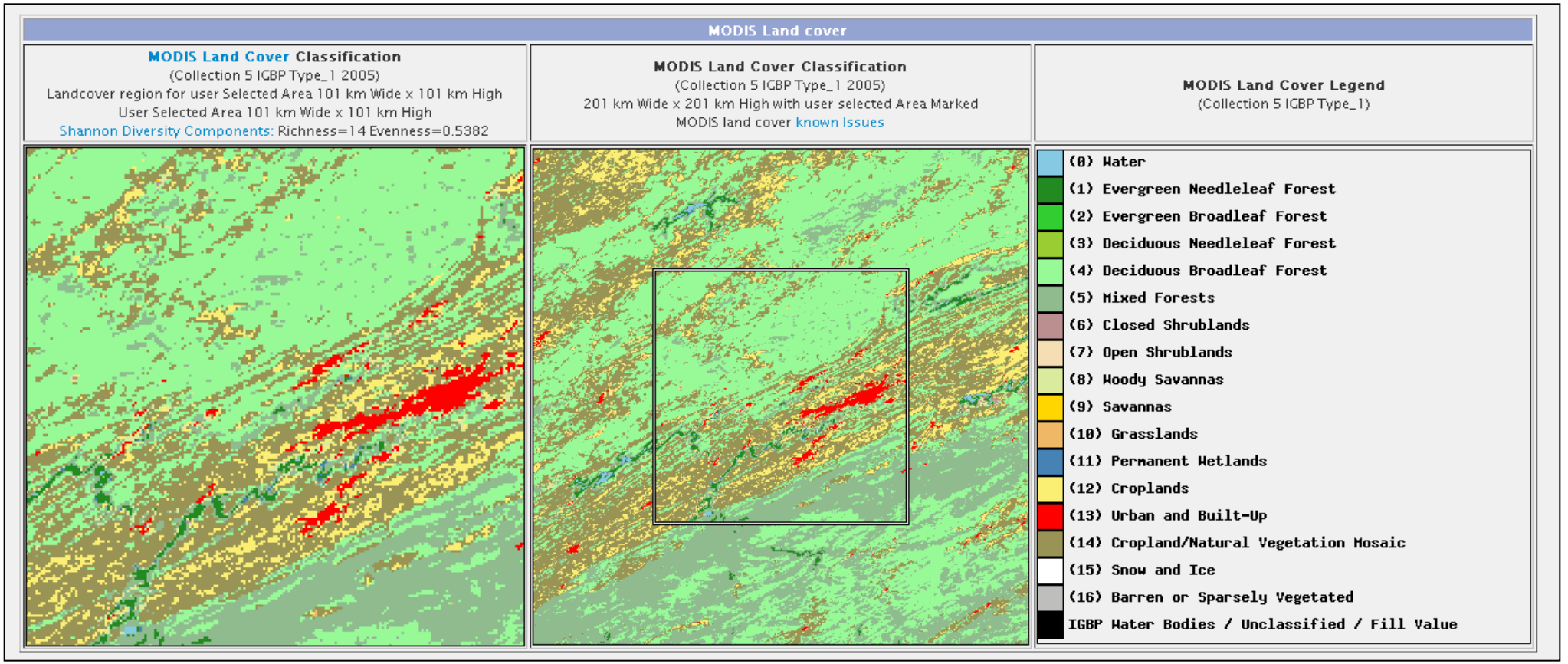
Scroll Bar

Color Legend	
Red	Average of all Pixels in Grid having Acceptable Quality
Blue	Site/Tower Pixel having Acceptable Quality
Green	Percent of Pixels having Acceptable Quality
Rainbow	Average of all Pixels in Grid having Acceptable Quality(Stacked)

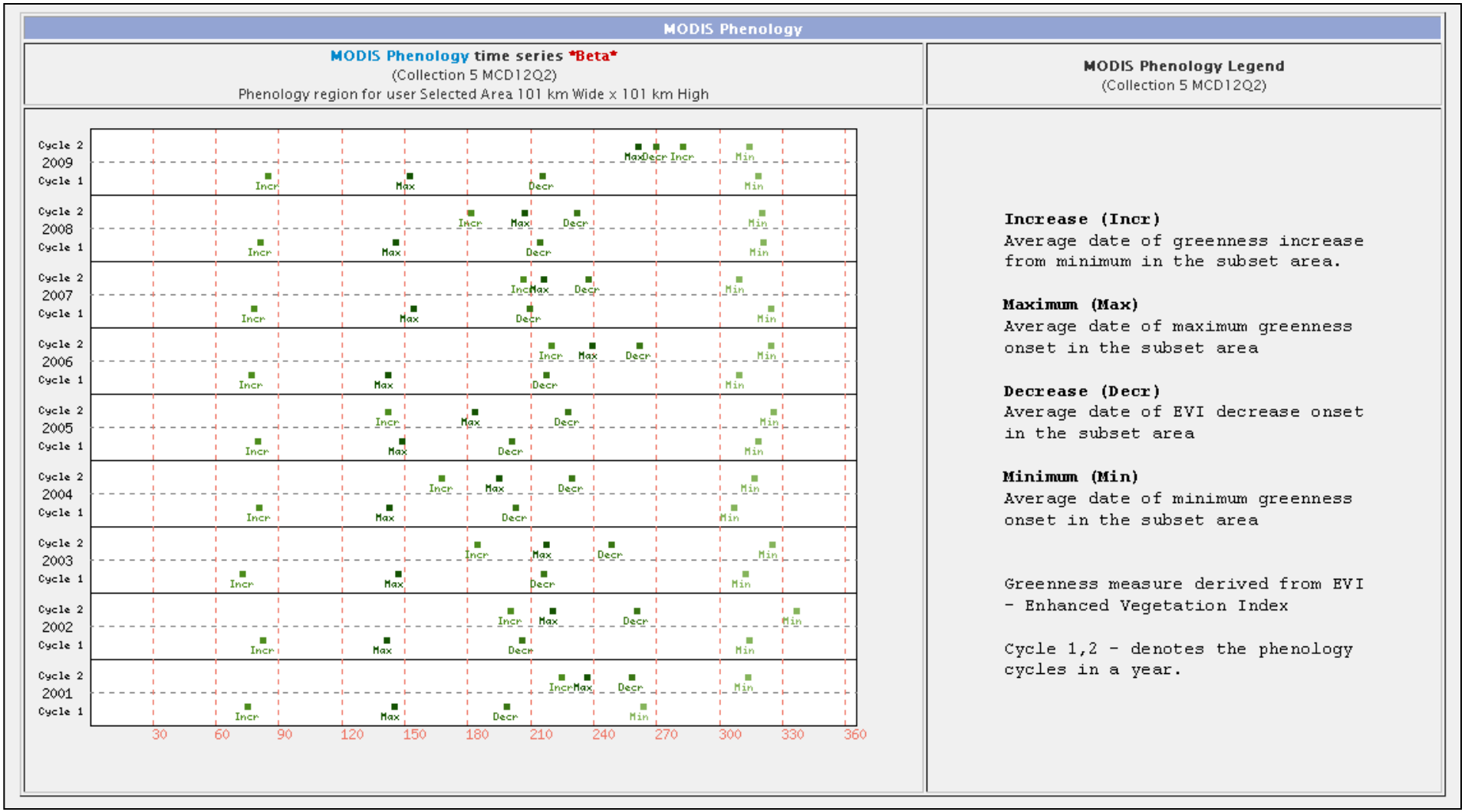
- Subset Download Details – links to data files produced by subset order
- Help Links provided



- MODIS IGBP Land Cover Classification Map with legend



- MODIS Phenology time series with Legend



- Quality Filter Conditions and QC explanations Summary
- Option to restart the Visualization or Create another subset for the same location

QC Filter Conditions
QC explanation for MODIS/Terra Land Surface Temperature/Emissivity LST_QC
QC bit word numbering (0,1,2,3,4,5,6,....n):(n=7 or 15 or 31)

Filter Class	Bits	Binary	QA-bits (Left to Right)	Value(Binary)	Value(Integer)	Bands applied	QC band	Description	Display
Mandatory_QA	8	yes	6-7	00	0	LST_Day_1km	QC_Day	LST produced, good quality, not necessary to examine more detailed QA	**Presented**
Mandatory_QA	8	yes	6-7	01	1	LST_Day_1km	QC_Day	LST produced, other quality,recommend examination of more detailed QA	**Presented**
Mandatory_QA	8	yes	6-7	10	2	LST_Day_1km	QC_Day	LST not produced due to cloud effects	**Supressed**
Mandatory_QA	8	yes	6-7	11	3	LST_Day_1km	QC_Day	LST not produced primarily due to reasons other than cloud	**Supressed**
Mandatory_QA	8	yes	6-7	00	0	LST_Night_1km	QC_Night	LST produced, good quality, not necessary to examine more detailed QA	**Presented**
Mandatory_QA	8	yes	6-7	01	1	LST_Night_1km	QC_Night	LST produced, other quality,recommend examination of more detailed QA	**Presented**
Mandatory_QA	8	yes	6-7	10	2	LST_Night_1km	QC_Night	LST not produced due to cloud effects	**Supressed**
Mandatory_QA	8	yes	6-7	11	3	LST_Night_1km	QC_Night	LST not produced primarily due to reasons other than cloud	**Supressed**

Restart this Visualization | Create subsets for this location